

*RANUNCULUS* SECTION *ECHINELLA*  
(*RANUNCULACEAE*) IN THE SOUTHEASTERN  
UNITED STATES

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ABSTRACT

As highlighted by the SEM, surficial sculpturings of the achenes of seven species of *Ranunculus* section *Echinella* adventive within the southeastern United States show two species with incurved trichomes and five species with protuberances and spines of varying lengths and frequency. A key, descriptions, habitats, and ranges within the southeastern United States of the seven species are included.

INTRODUCTION

During an extensive study of the *Ranunculaceae* for the forthcoming volume 2 of the *Vascular Flora of the Southeastern United States*, it became increasingly apparent that members of the echinate group of *Ranunculus* were frequently misdetermined. This is due chiefly to the lack of a comprehensive treatment of these seven species, all naturalized from Europe or South America. Small's *Manual* (Small 1933) included only three species (*R. muricatus*, *R. parviflorus*, and *R. sardous* as *R. parvulus*), Radford (1968) treated four species (*R. arvensis*, *R. muricatus*, *R. parviflorus*, and *R. sardous*), while Benson (1948, 1954) described six species in his exhaustive review of the North American *Ranunculi*. Moreover, some of the species (e.g., *R. platensis*, Keener, unpubl. research) appear to be migrating rapidly, and thus to aid in understanding the taxonomy of this somewhat weedy group, the following general treatment is offered.

Species of *Ranunculus* sect. *Echinella* are demarked chiefly by the sculpturings of the achene faces: small tubercles, spines, or recurved trichomes, and thus differ from all other species of *Ranunculus* within the southeastern United States. Moreover, all are annuals with yellow petals, divided or

TABLE 1. Voucher specimens for the SEM study. All specimens are deposited at PAC.

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1.	<i>RANUNCULUS ARVENSIS</i> L. NORTH CAROLINA: Durham Co.: 2 mi NW of Durham, <i>Blomquist</i> 16404 (Fig. 4C). LOUISIANA: Madison Parish: Willow Bayou Road, 0.3 mi N of U.S. 80, <i>Rich &amp; Scirria</i> 1817 (Fig. 4D).
2.	<i>R. MARGINATUS</i> D'Urv. LOUISIANA: Caddo Parish: 10.5 mi S of Shreveport, <i>MacRoberts</i> 2630 (Fig. 3A, B).
3.	<i>R. MURICATUS</i> L. TEXAS: Brazos Co.: Pexter Park, College Station, <i>Gilmore</i> 27 (Fig. 4A, B).
4.	<i>R. PARVIFLORUS</i> L. NORTH CAROLINA: Chatham Co.: 3 mi N of Farrington, <i>Ables &amp; Haesloop</i> 53318 (Fig. 1A, B).
5.	<i>R. PLATENSIS</i> Sprengel. NORTH CAROLINA: Durham Co.: Duke University, Durham, <i>Murphy &amp; Hammel</i> 732 (Fig. 1C, D).
6.	<i>R. SARDOUS</i> Crantz. TENNESSEE: Montgomery Co.: 8 mi SW of Clarksville, <i>Chester</i> 4030 (Fig. 2A). ARKANSAS: Clark Co.: Arkadelphia, <i>Demaree</i> 69393 (Fig. 2B).
7.	<i>R. TRILOBUS</i> Desf. LOUISIANA: St. Martin Parish: 4.2 mi W, 3.5 mi S of Butte La Rose, <i>Haynes</i> 4666 (Fig. 2C, D).

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lobed basal leaves, and as colonizers inhabit waste ground, fallow fields, roadside banks and ditches, low clearings, and streambanks.

#### MATERIALS AND METHODS

Herbarium specimens forming the basis of the taxonomic treatment were examined from ALU, DUKE, FLAS, FSU, GA, GH, LAF, LSUS, NCSC, NCU, NLU, NO, OSH, PAC, SMU, UNA, US, VPI, and WIS. Achenes used in the SEM study were taken from specimens deposited at PAC (Table 1).

Achenes were mounted on aluminum stubs using either double-sided transparent tape or silver-conductive adhesive, then coated with gold for four minutes using an ISI Carbon and Gold Sputterer. Specimens were observed and photographed (Agfa Pan 100 — 35 mm film) with ISI Scanning Electron Microscope.

#### MICROMORPHOLOGY OF THE ACHENE SURFACE

Achenes within *Ranunculus* section *Echinella* exhibit surficial sculpturings ranging from simple trichomes to protuberances and spines of varying lengths (*see* Theobald et al. 1979, for a description and classification of trichomes). Although the terminology for referring to these sculpturings is by no means uniform, we are using "trichome" to indicate the short, more or less recurved unicellular hairs found on the achenes of *Ranunculus parviflorus* and *R. platensis*. All remaining species have multicellular protuberances or spines of varying lengths and acuteness. Occasionally, especially in *R. sardous*, these protuberances appear as papillate swellings, but the term papillate is better reserved for similarly shaped protuberances within single cells (Wilkinson 1979).

Consequently, we recognize two main types of achene micromorphology for critical taxonomic purposes: 1) simple trichomes, and 2) multicellular protuberances and spines of varying lengths (0.05 to ca 1.0 mm). Protuberances tend to be quite short and “papillate” in appearance under low light magnification, whereas spines are longer and appear to be more sharply pointed (cf. Figs. 2B, D and 4A – C). Accordingly, the achenes of each species are described in more detail below.

Fig. 1A, B. *Ranunculus parviflorus*. Trichomes simple, unicellular, recurved, to 0.12 mm long, attached basally to short multicellular conelike protuberances, less frequent on the achene margins.

Fig. 1C, D. *R. platensis*. Trichomes simple, unicellular, somewhat recurved, to 0.16 mm long, attached basally to slightly raised multicellular projections, less frequent on the achene margins.

Fig. 2A, B. *R. sardous*. Protuberances multicellular, present or absent; when present, usually occurring toward the margins of the achene face, conelike (“papillate” in appearance), short (to 0.05 mm long).

Fig. 2C, D. *R. trilobus*. Spines multicellular, conelike, to 0.16 mm long, absent on the achene margins.

Fig. 3A, B. *R. marginatus*. Ornamentation similar to *R. trilobus* except that the spines (to 0.17 mm long) can be absent or sparse in the central area of the achene face.

Fig. 4A, B. *R. muricatus*. Spines multicellular, conelike, to 0.60 mm long, with rough striations, absent on the achene margins.

Fig. 4C, D. *R. arvensis*. Spines multicellular, conelike, sometimes recurved, of varying lengths up to 0.57 mm long centrally, 0.85 mm long marginally, present (sometimes absent - Fig. 4D) on both the achene face and the marginal ridge; low ridges often present on the achene face, the surface (including the spines) rough with striations, the margins usually smoother.

#### TAXONOMIC CLASSIFICATION

RANUNCULUS L. subgenus *Ranunculus* section *Echinella* DC., Prodr. 1:41. 1824. TYPE: *Ranunculus arvensis* L., Sp. Pl. 555. 1753.

Erect to reclining glabrous to variously pubescent annuals with stems 1–6 dm tall, simple to freely branching above. Leaves basal and cauline or chiefly cauline, the basal simple and variously lobed and parted to pinnately compound, typically 2–8 cm wide; petioles 1–21 cm long. Cauline leaves alternate, generally similar to basal leaves, upwardly reduced, usually petiolate. Inflorescence 1(–2)-flowered, axillary or opposite the leaves, sessile or pedunculate, the peduncles lengthening to 5 cm in fruit. Sepals 3 or 5, spreading to reflexed, usually deciduous, 1–7 mm long, variously pubescent; petals 3 or 5, yellow, narrowly elliptic to obovate, 1–10 mm long, the nectary scale truncate, entire. Achenes 4–60, orbicular to subrotund, compressed to rounded, the

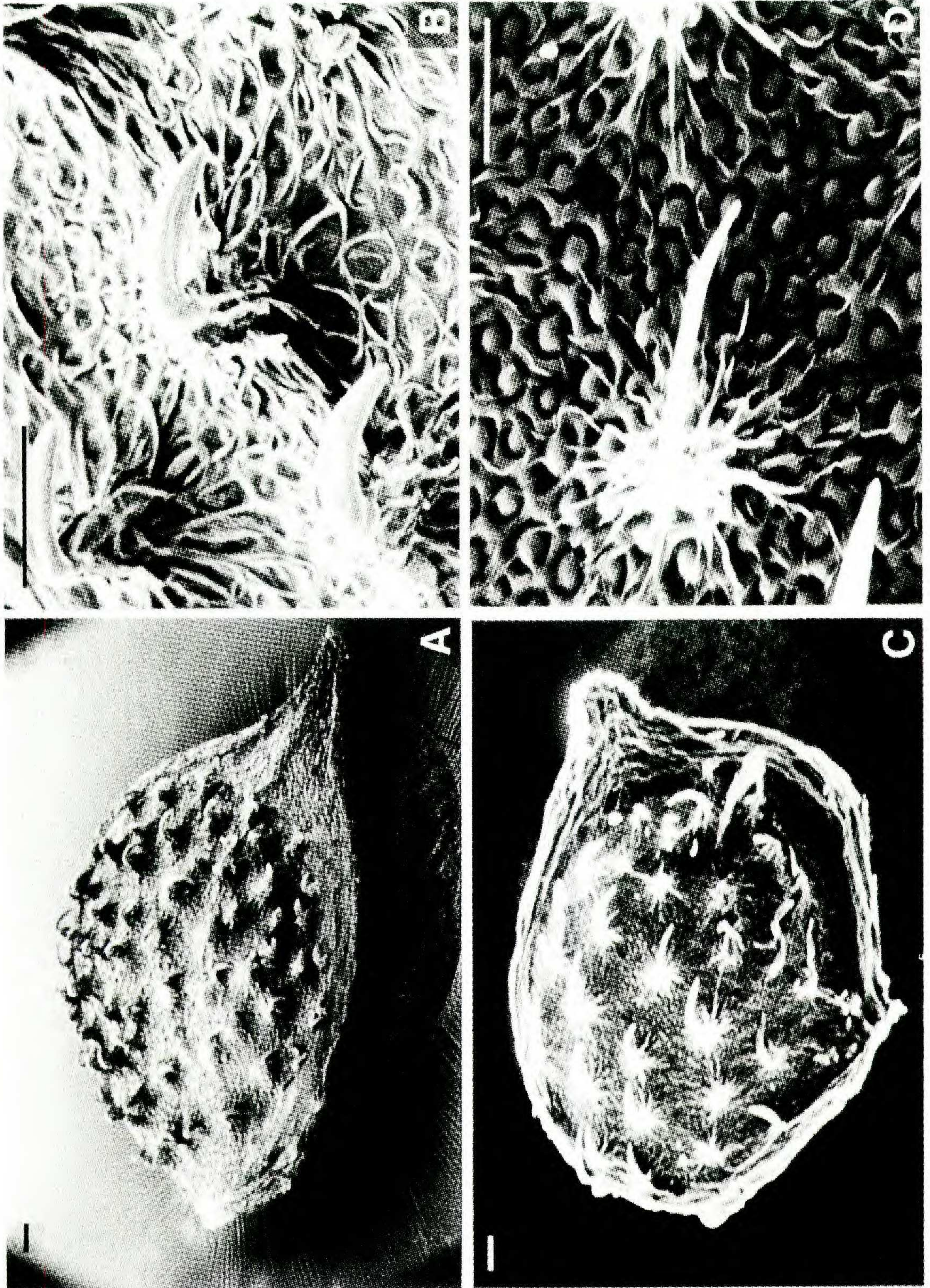


Figure 1. Scanning electron micrographs of achene surfaces. Scale = 100  $\mu\text{m}$ . A, B: *Ranunculus parviflorus*. C, D: *R. platensis*.

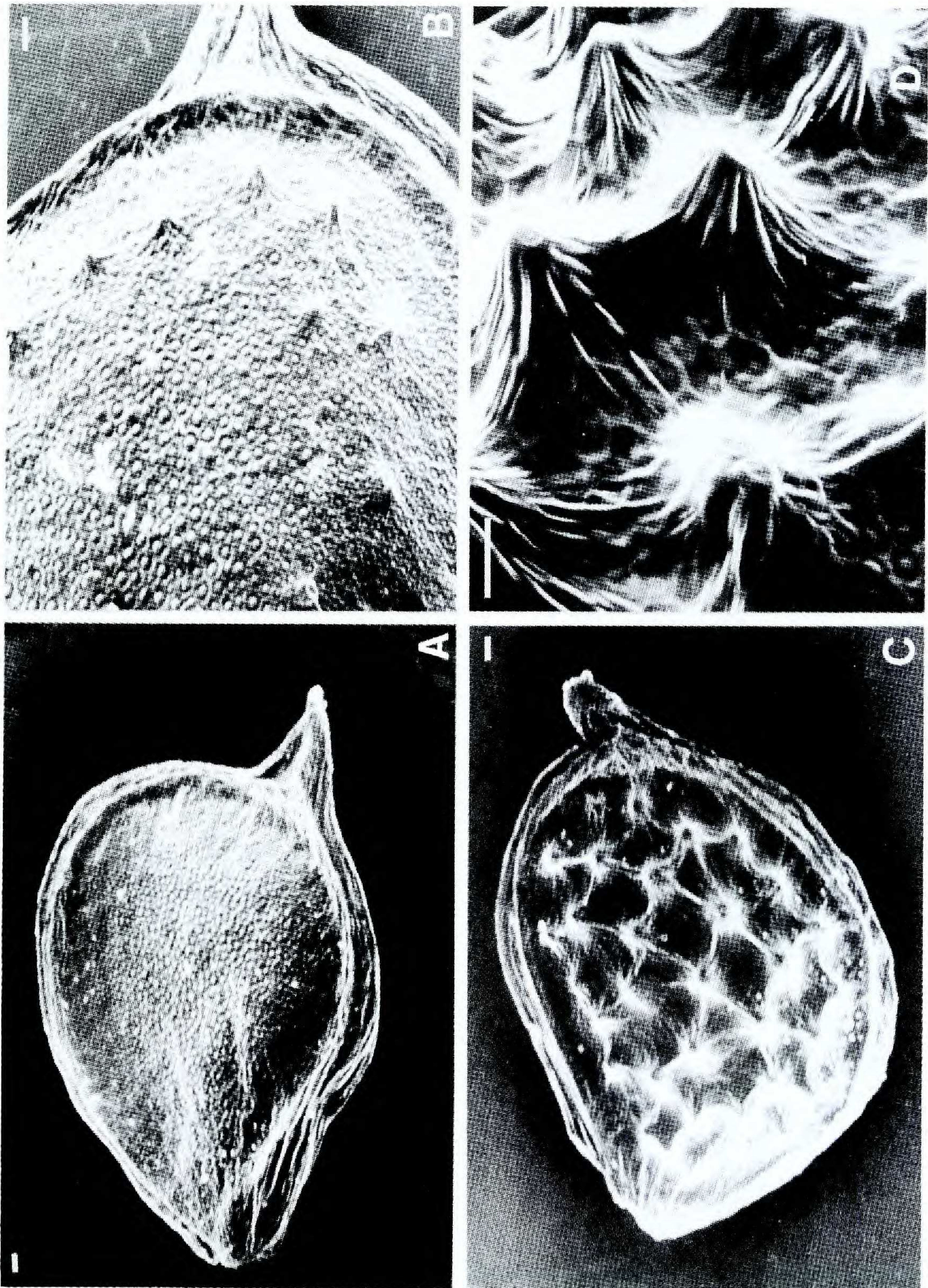


Figure 2. Scanning electron micrographs of achene surfaces. Scale = 100  $\mu\text{m}$ . A, B: *Ranunculus sardous*. C, D.: *R. trilobus*.

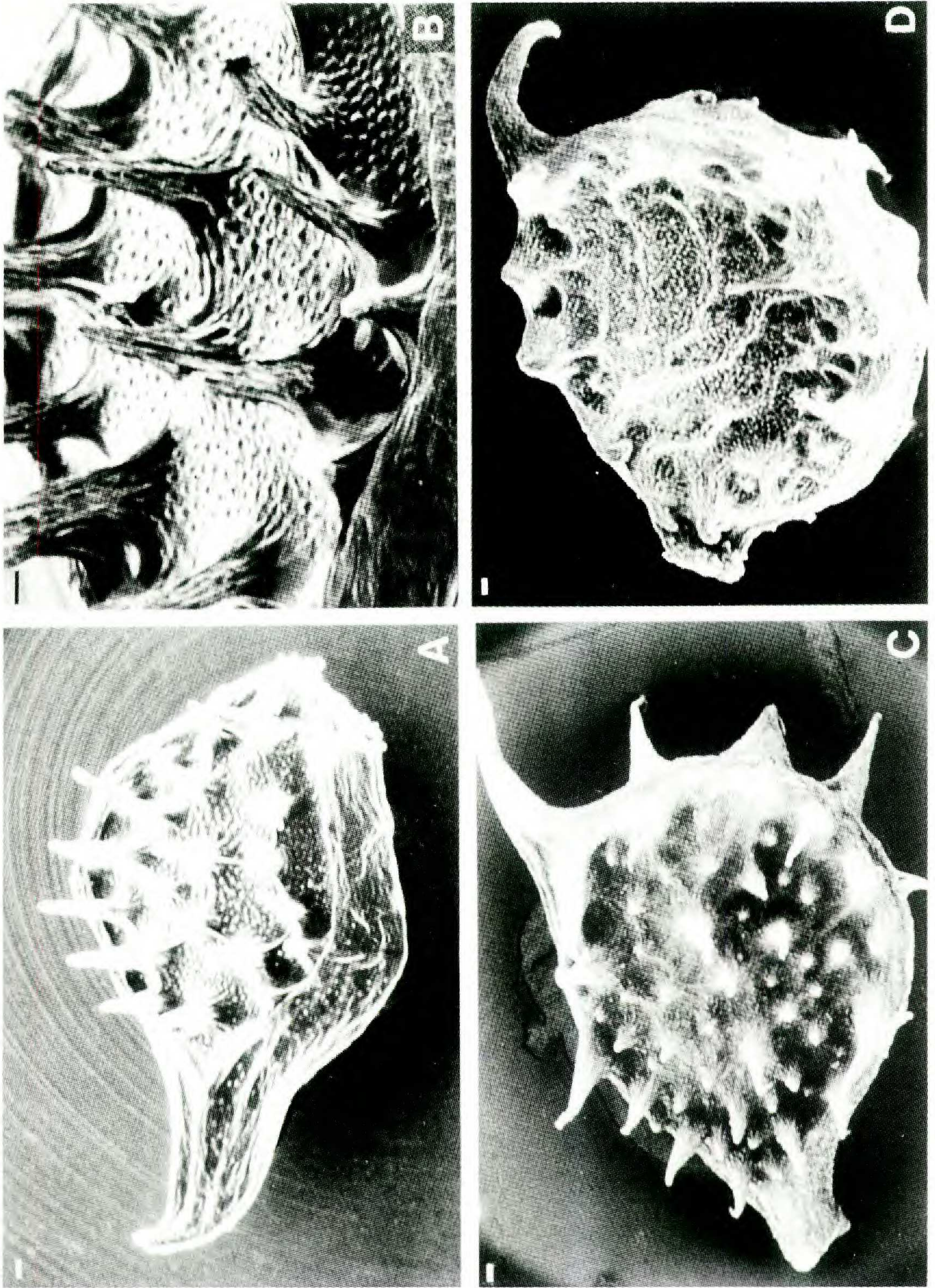


Figure 3A, B. Scanning electron micrographs of achene surfaces of *Ranunculus marginatus*. Scale = 100  $\mu\text{m}$ .

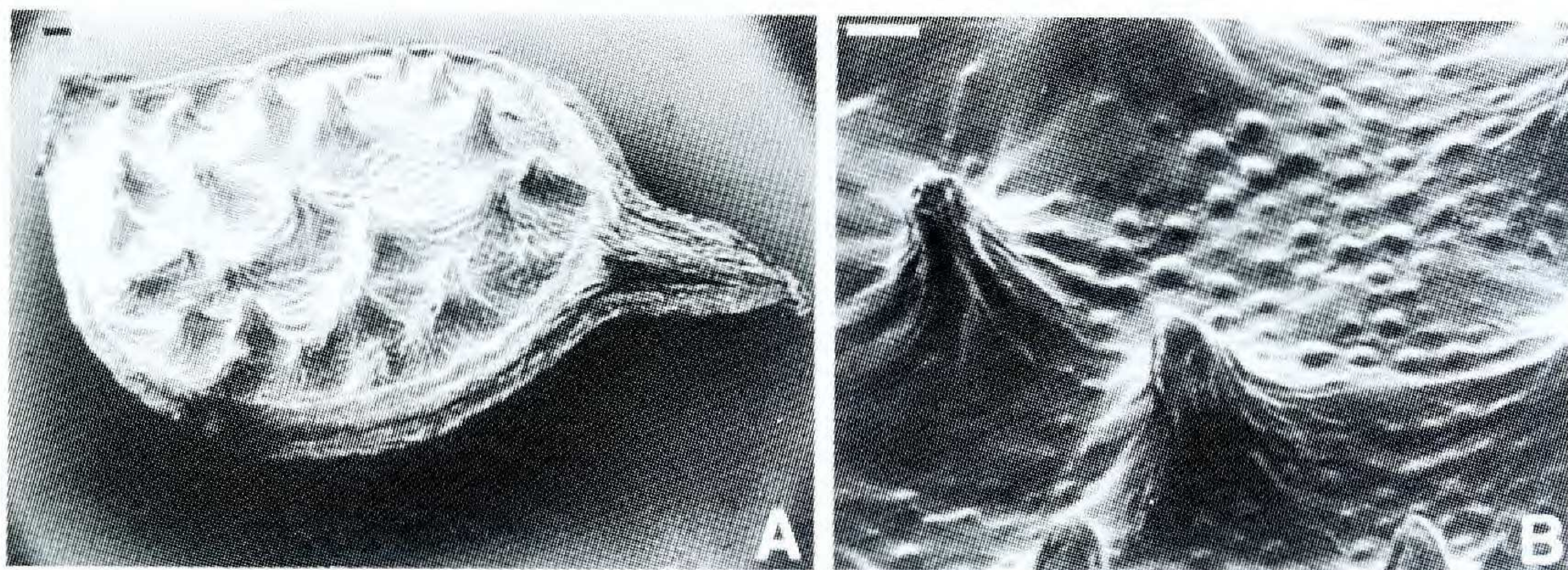


Figure 4. Scanning electron micrographs of achene surfaces. Scale = 100  $\mu\text{m}$ . A, B: *Ranunculus muricatus*. C, D: *R. arvensis*.

bodies 2–5 mm long, discs variously sculptured with recurved trichomes or with short protuberances to stout spines, the margins smooth to spiny; beaks minute to 3 mm long, straight to curved or hooked. Fruiting receptacles globose to ellipsoid or pyriform, 1–5 mm long, generally pubescent. Chromosome numbers:  $n=8, 14, 16, 24$ . Adventive from South America (*R. platensis*) or Europe and established in lawns, moist fields, roadside banks and ditches, and waste places.

KEY TO SPECIES OF RANUNCULUS SECT. ECHINELLA  
WITHIN THE SOUTHEASTERN UNITED STATES

1. Flowers pedunculate, the peduncles usually elongating in fruit, axillary; sepals and petals usually 5; achenes with recurved trichomes or with short protuberances to stout spines . . . . . 2.
1. Flowers sessile, opposite the petioles; sepals and petals 3; achenes with recurved trichomes only . . . . . 1. *R. platensis*
2. Petals 1–3 mm long; mature achenes with multicellular projections, each bearing a short recurved trichome; receptacles glabrous . . . . . 2. *R. parviflorus*
2. Petals 3 mm or more long; mature achenes short protuberant (rarely smooth) or with straight to curved spines of varying lengths; receptacles pubescent (see Table 2) . . . . . 3.
3. Achenes short protuberant (or sometimes more or less smooth) to short spiny, the bodies less than 3 mm long; achene beaks usually less than 0.5 mm long . . . . . 4.
3. Achenes conspicuously spiny, the bodies usually more than 3 mm long; achene beaks at least (0.75) 1 mm long . . . . . 5.
4. Achene discs sparsely protuberant to smooth; petals more than 5 mm long; plants more or less hirsute . . . . . 3. *R. sardous*
4. Achene discs with numerous short spines; petals less than 5 mm long; plants with a few scattered villous hairs . . . . . 4. *R. trilobus*
5. Achenes 9 or fewer, in a single whorl; achene discs and margins with spines of varying lengths; largest leaves compound, the ultimate segments linear to obovate . . . . . 5. *R. arvensis*

5. Achenes usually 10 or more, not in a single whorl; achene discs tuberculate to long-spiny, the margins smooth; largest leaves simple, broadly cordate to suborbicular and more or less 3–5-parted, the segments crenately lobed or toothed . . . . . 6.
6. Achene discs usually stout-spiny, the spines ca 0.5 mm long; achene beaks at least 1.5 mm long; peduncles usually shorter than the subtending leaf; plants often subglabrate . . . . . 6. *R. muricatus*
6. Achene discs short-spiny, the spines usually less than 0.2 mm long; achene beaks ca 1 mm long; peduncles usually longer than the subtending leaf; plants sparsely hispid . . . . . 7. *R. marginatus*

1. *R. PLATENSIS* Sprengel, Syst. Veg. 5:586. 1827. Weak-stemmed pilose annual; stems 2–4 dm long. Leaves mostly cauline, alternate, 3-parted, reniform, 1.5–2.0 cm wide, segments 3–5-lobed; upper leaves gradually reduced; petioles 2–5 cm long. Inflorescence 1(–2)-flowered; flowers solitary (or 2), sessile, scattered along the stem opposite the leaves. Sepals 3, concave, 2 mm long; petals 3, ca 2 mm long. Achenes subrotund, 1.2 mm broad, with short multicellular projections, each projection bearing a slender recurved trichome, margins narrow; beaks relatively broad, curved, minute. Fruiting receptacles globose, 1 mm long, glabrous or pilose. Spring. Sandy clearings along streams, moist fields, and road sides, etc., rare, but locally abundant, especially in SE La; cp. Ala, Fla, Ga, La, Miss, and NC. [Tex]. Similar to *R. parviflorus* (No. 2).

2. *R. PARVIFLORUS* L., Syst. Nat. Ed. 10:1087. 1759. Erect to lax, hirsute to softly pilose, slender annual; stems 1–4 dm tall, freely branching. Basal leaves shallowly to deeply 3–5-parted, reniform to cordate-rotund, 2–5 cm wide, lobes or segments crenate to sharply toothed; petioles 3–10 cm long. Cauline leaves alternate, similar to basal leaves, upwardly reduced, short-petiolate. Inflorescence 1-flowered, axillary; peduncles 1–4 mm long, lengthening to 20 mm in fruit. Sepals 5, spreading, soon deciduous, narrowly ovate, ca 1 mm long, densely pubescent; petals 5, yellow, narrowly elliptic, 1–3 mm long. Achenes subrotund, 1–2 mm broad, discs brownish-protuberant, protuberances terminating in a short recurved trichome, margins conspicuous, greenish, nearly smooth; beaks deltoid, hooked, ca 0.5 mm long. Fruiting receptacles globose, 1–1.3 mm long, glabrous. ( $n=14$ ) Spring, summer. Fields and waste places; chiefly cp. and pied. SE except Del and WVa. [Tex, Okla, and Mo].

3. *R. SARDOUS* Crantz, Stirp. Austr. Fasc. 2:84. 1763. Erect to suberect usually hirsute annual (perennial?) with the overall habit of *R. bulbosus*; stems 1–6 dm tall, usually freely branching. Basal leaves simple, 3-parted to pinnately compound, 2–4(10) cm wide; segments widely tri-



TABLE 2. The spiny achene group of *Ranunculus* section *Echinella*.

CHARACTERS	ARVENSIS	MARGINATUS	MURICATUS	SARDOUS	TRILOBUS
Basal leaves	simple, trifold to trilobed or trisected	simple, $\pm$ lobed to deeply parted, rarely compound	Simple, $\pm$ lobed to deeply parted, rarely compound	mostly compound	(simple) . . . compound
Petal color	yellow	deep yellow	deep yellow	pale yellow	pale to deep yellow
Petal length (mm)	6-8	3-4	5-8	5-10	3-5
Achene head shape	flattened	flattened-globose	flattened-globose	globose	globose
No. achenes/head	4-9	10-20	10-20	30-40	40-60
Achene body length (mm)	4-5	2-3.5	3-5	2.5-3	3(2)
Achene beak length (mm)	2.5-3	(0.75)-1	1.5-2.5	0.5	0.5
Achene face	spiny	spiny	spiny	protuberant to smooth	spiny
Achene margins	spiny	smooth	smooth	smooth	smooth
Maximum protuberance or spine length (mm)	facial: 0.57 marginal: 0.85	0.17	0.60	0.05	0.16
Fruiting receptacle length (mm)	1-2	2	2	2	3-5

angular-obovate, variously lobed and incised; petioles 3–21 cm long. Cauline leaves alternate, generally similar to basal leaves, petiolate. Inflorescence 1-flowered, axillary; peduncles 3–5 cm long. Sepals 5, reflexed, deciduous, ovate, 3–5 mm long, pilose; petals 5, yellow, narrowly elliptic, 5–10 mm long; stamens 25–50. Achenes discoid, 2–3 mm long and broad, discs sparsely protuberant to smooth, glabrous, margins conspicuously rimmed; beaks deltoid, 0.2–0.5(1) mm long, hooked to straight. Fruiting receptacles pyriform, 2 mm long, pubescent. ( $n = 8, 24$ ) Spring, summer. Low wet fields and waste places; chiefly cp. and pied. Ala, Ark, Ga, Ky, La, Miss, NC, SC, Tenn, and Va. [Tex, Okla, Mo, Ill, Pa, and NJ]. *R. parvulus* L.—Small (1933). Frequently *R. sardous* is confused with *R. bulbosus* L., and therefore to aid in determining specimens referable to these two species a supplemental key is provided.

Plants soft-based annuals; petals 5–8(10) mm long; achenes smooth to protuberant, more or less uniformly thick throughout or slightly bulged in the center, the faces generally orbicular, usually flat . . . . . *R. sardous*  
 Plants cormose perennials; petals 8–14 mm long; achenes smooth, unevenly thick, the apex much thicker than the base, the faces asymmetrically obovate to orbicular, variously bulged . . . . . *R. bulbosus*

4. *R. TRILOBUS* Desf., Fl. Atlant. 1:437. 1798. Sparsely pubescent annual similar to but overall generally larger than *R. sardous*. Basal leaves simple and 3-foliolate, the largest 3–7 cm wide. Petals 5, 3–5 mm long; stamens 10–20. Achenes 40–60, 2–3 mm long, the discs with numerous short spines; beaks short deltoid, 0.2–0.5 mm long. Fruiting receptacles ellipsoid, 3–5 mm long, pubescent. ( $n = 16$ ) Spring. Low clearings, fields, and wet roadside ditches, locally common; cp. Ala, Fla, La, and SC. [Tex]. Apparently recently introduced from southwestern Europe. This species can be confused with *R. marginatus* (No. 7) and to facilitate determining specimens, a supplemental key is added.

Achene heads globose, achenes tightly packed, 40–60 per head; achene beaks 0.5 mm or less long; fruiting receptacles 3–5 mm long . . . . . *R. trilobus*  
 Achene heads globose to flattened; achenes usually spreading, ca 20 per head; achene beaks 0.75–1 mm long; fruiting receptacles ca 2 mm long . . . *R. marginatus*

5. *R. ARVENSIS* L., Sp. Pl. 555. 1753. Erect, glabrous to sparsely hirsute annual; stems 1.5–5 dm tall, simple to freely branching above. Basal leaves simple, cuneate-obovate, ca 1 cm wide, trifid to trilobed or trisect; petioles 1–5 cm long. Cauline leaves alternate, compound, dissected into linear, entire or narrowly cuneate-oblongate incised or lobed segments to 5 mm wide; petiolate or sessile. Inflorescence 1-flowered, axillary; peduncles 1–3.5 cm, lengthening to 5 cm in fruit. Sepals 5, spreading, deciduous, narrowly elliptic, 4–7 mm long, hirsute; petals 5, yellow,

obovate, 6–8 mm long. Achenes 4–9, obliquely obovoid, compressed, 4–5 mm long (excluding the beak) and 3–4 mm broad, discs and margins diversely sculptured, typically with spines of varying lengths; beaks stout, subulate, straight to curved, 2.5–3 mm long. Fruiting receptacles subglobose, 1–2 mm long, pubescent. ( $n=16$ ) Spring, summer. Fields and waste ground, uncommon; chiefly cp. and pied. Ark, Ga, Miss, NC, SC and Tenn. [Mo, Ohio, and NJ]. Including *R. arvensis* var. *tuberculatus* (DC.) Koch, a form with merely tuberculate (short spiny) achenes.

6. *R. MURICATUS* L., Sp. Pl. 555. 1753. Reclining or weakly erect glabrous to sparsely hirsute annual (perennial?); stems 0.5–5 dm tall, freely branching. Basal leaves shallowly to deeply 3–5-parted or rarely pinnately divided, broadly cordate or reniform to subrotund, 2–8 cm wide, the segments lobed or crenate to sharply toothed; petioles 4–15 cm long. Cauline leaves alternate, similar to the basal leaves, upwardly reduced. Inflorescence 1-flowered, axillary; peduncles usually shorter than the subtending leaf. Sepals 5, spreading to reflexed, deciduous, ovate, 4–7 mm long, sparsely hairy; petals 5, yellow, obovate, 5–8 mm long. Achenes 10–20, obovoid, compressed, 3–5 mm long (excluding the beak) and 3–3.5 mm broad; discs brownish, usually stout spiny, the spines ca 0.5 mm long, margins conspicuous, greenish, smooth; beaks stout, falcate, 1.5–2.5 mm long. Fruiting receptacles subglobose, 2 mm long, pubescent. ( $n=24$ ) Spring. Low meadows, ditches, and stream banks; cp., rarely inland. Ala, Ark, Fla, La, Miss, and SC. [Tex].

7. *R. MARGINATUS* D'Urville, Mém. Soc. Linn. Paris 1:318. 1822. Pubescent annual similar to *R. muricatus*. Upper cauline leaves divided into narrowly oblong or linear segments. Peduncles usually longer than the subtending leaf. Petals 5, usually less than 4 mm long. Achenes ca 20, obovoid-orbicular, compressed, ca 3 mm long (excluding the beak), short spiny, the spines usually less than 0.2 mm long; margins smooth, beaks erect, triangular, ca 1 mm long. Fruiting receptacles subglobose, 2 mm long, sparsely pubescent. Spring. Roadside ditches, locally common; cp. Ala and La. [Tex]. In var. *marginatus* the achene discs are smooth, but our plants have spiny achenes and may be distinguished as var. *trachycarpus* (Fischer & Meyer) Azn. See note under *R. trilobus* (No. 4).

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